MYCOFLORA OF HAIR, FEATHER AND FLOORING MATERIALS UNDER COWS AND CHICKENS AT QENA, EGYPT

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ABSTRACT - The mycological analysis of 60 samples of cow hair, layer-strains and broiler feather showed the high prevalence of *Aspergillus flavus, A. flavus* var. *columnaris, Chrysosporium indicum, Scopulariopsis brevicaulis* and *Paecilomyces variotii*. The common fungi in the flooring materials under cows and chickens included several species belonging to *Aspergillus, Emericella, Eurotium, Mucor, Penicillium, Rhizopus, Scopulariopsis, Chrysosporium* and others. The monthly fluctuations in the counts of total fungi in the flooring materials were almost irregular ranging from 16.6 to 183.3 colonies/mg dry sample.

INTRODUCTION

Fungi especially keratinophilic species have been found to contaminate feather, hair or other organs of birds and animals (Pugh & Evans, 1970; Hubalek, 1974, Aho, 1980, 1983; Bagy, 1986; Bagy & Abdel-Hafez, 1985 and others). Also there are many accounts of the prevalence of fungal propagules in the flooring material under poultry and animals. The flooring material may incorporate litter, faecal matter, dropping, dung, soil, keratinaceous substrates, food residues, etc. In U.K., Dennis & Gee (1983) found that *Paecilomyces variotii, Trichoderma* spp., *Aureobasidium pullulans* and *Hyalodendron lignicola* predominated in the fresh litter of broiler house but were replaced by *Scopulariopsis brevicaulis* and *Aspergillus* spp., in the final samples. In India, Sambyal *et al.* (1980) isolated 59 fungal isolates which included *Absidia* spp., *Aspergillus* spp., *Penicillium* spp. and *Curvularia* spp. Similar informations have also been reported by Lovett *et al.*, (1971); Ogundero (1979), Moharram *et al.* (1987), Bagy *et al.* (1989).

This investigation was designated to study the existence of keratinophilic fungi on cow hair and chicken feathers and to follow the monthly variations in the fungal populations of cows manure, layer strains and broiler litter inside the houses of these animals or chickens.

MATERIALS AND METHODS

I - Mycological analysis of hair and feather samples

a) Keratinophilic fungi

Twenty samples of each of cow hair, layer strains and broiler feather were collected from the cattles and chickens in Farms at Qena, Upper Egypt. Cow hair fragments or chicken feathers segments were scattered on sterile soil moistened with water to 40 % water holding capacity. Two plates were used for each samples which were incubated at 28°C for up to 16 weeks and the cultures were moistened with sterile distilled water whenever necessary. To confirm identification parts of fungal mycelium growing on hairs or feathers were transferred to Sabouraud's dextrose agar supplemented with chloramphenicol and cycloheximide (0.5 g/L for each).

b) Thermophilic and thermotolerant fungi:

Hair fragment or feathers were plated on the surface of yeast starch agar medium (Emerson, 1941). Two plates were used for each sample (two fragments per plate) which were incubated at 45°C. To avoid excessive loss of water plates were kept inside plastic bags and a jar filled with water was placed inside the incubator till the end of incubation period. After 7 days incubation, the growing fungi were identified and isolated.

II -Mycological analysis of cow manure an chicken litter

a) Mesophilic fungi: were isolated on glucose-Czapek's agar using the dilution plate method (Johnson & Curl, 1972) and the cultures were incubated at 28°C.

b) Keratinophilic fungi: were isolated using the hair baiting technique (Vanbreuseghem, 1952). Sterile cow hair fragments were plated on the surfaces of the manure or litter sample (about 50 gram sample per plate). Cultures were incubated at 28°C for 4 weeks after which the growing fungi were transferred onto Sabouraud's dextrose agar in order to purify and identify the keratinophilic and cycloheximide resistant moulds.

c) Thermophilic fungi: were isolated on yeast starch agar (Emerson, 1941) using the dilution plate method. Cultures were incubated at 45°C for 7 days after which fungi were identified and counted.

III - Determination of some physicochemical characteristics of the flooring materials

The moisture content of the monthly samples of the different flooring materials was determined by the percentage loss in weight of 100 g fresh sample after dryness at 105°C for 24 hours. The total soluble salts were determined by shaking a known weight of sample (on dry weight basis) in a known volume of water for 1 hour, samples were filtered and the filtrate was dried at 105°C. The dry residue was weighed and calculated as percentage soluble salts.

The pH values were determined using a pH meter (Orior Research model 601 T digitalionalizer).

RESULTS AND DISCUSSION

I - Hair and Feather fungi

a) Keratinophilic fungi

Forty species and 1 variety of keratinophilic and cycloheximide resistant fungi representing 17 genera were collected from cow hairs (10 genera, 16 species and 1 variety), layer strains (11 genera, 19 species and 1 variety) and broiler feathers (16 genera, 23 species and 1 variety) as shown in Table 1.

Aspergillus was the most common genus on all samples, being covered from 50%, 100% and 90% of cow hairs, layer strains and broiler feathers respectively. Of the 7 *Aspergillus* species *A. flavus, A. flavus* var. *columnaris* were generally the most common. Other *Aspergillus* species such as *A. niger, A. ochraceus, A. parasiticus, A. sydowii, A. tamarii* and *A. versicolor* were less frequently isolated. The above *Aspergillus* species have been reported to be recovered from hairs of camel, cow, donkey and goat in Egypt (Bagy & Abdel-Hafez, 1985; Bagy, 1986) from goat and sheep hairs in Gaza strip (Abdel-Hafez, 1987), from hair of cows, donkeys, goats, rabbits, cats and dogs from the west bank of Jordan (Ali Shtayeh *et al.*, 1988 a, b).

Chrysosporium was also prevalent on the hair and feather samples being recovered from 55%, 100% and 65% of cow hair, layer strains and broiler feathers respectively. Of the 4 species of *Chrysosporium, C. indicum* was the most common on feathers of layer strains (65 % of the samples) and broiler (85 %). *C. tropicum* occurred in low to moderate incidences (15-25 % of the samples) while *C. keratinophilum* and *C. pannorum* were less frequently isolated from one or two types of substrate. These *Chrysosporium* species were previously recovered from animals and birds in Egypt (Bagy & Abdel-Hafez, 1985; Bagy, 1986; Moharram *et al.*, 1989); Johdan (Ali Shtayeh *et al.*, 1988a, b), as well as from mammals in Czechoslovakia (Otcenasek and Dvorak, 1962), Germany (Hoffmann *et al.*, 1970. India (Gugnani *et al.*, 1975) and Venezuela (Moraes *et al.*, 1967) and others countries.

Scopulariopsis was recovered from 60%, 20% and 50% of cow hair, layer strains and broiler feathers respectively. It was represented by 4 species of which *S. brevicaulis* was more frequently isolated than the others (15-50% of the samples). Several authors have reported the common existence of *S. brevicaulis* on hairs of mammals (Bagy & Abdel-Hafez, 1985; Abdel-Hafez, 1986; Ali-Shtayeh *et al.*, 1988 a, b, 1989). The remaining *Scopulariopsis* species such as *S. brumptii, S. candida* and *S. koningii* were less common in this work of Ali-Shtayeh *et al.*, 1988 a, b).

Penicillium was moderately recovered from 25-45% of the samples and was represented by 6 species namely *P. aurantiogriseum, P. chrysogenum, P. citrinum, P. jenseni, P. funiculosum* and *P. purpurogenum*. Each of these species occurred on 1-4 samples of one type or more of the three types of keratinaceous materials.

Table 1 - Number of cases of isolation (NCI, out of 20 samples) and occurrence remarks (OR) of keratinophilic fungi recovered from cow hair, layer strains and broiler feather samples on Sabouraudd's dextrose agar at 25°C.

Genera and species	Cow hair NCI & OR	Layer strains feather NCI & OR	Broiler feather NCI& OR
Acremonium strictum W. Gams	4 L	-	2 R
Aspergillus	10 H	20 H	18 H
A. flavus Link	6 M	4 L	10 H
A. flavus var. *columnaris* Raper & Fennell	3 L	19 H	11 H
A. niger Van Tieghem		5 M	-
A. ochraceus Wilhelm		-	1 R
A. parasiticus Speare		3 L	-
A. sydowii (Bain. & Sart.) Thom & Church		-	1 R
A. tamarii Kita		5 M	1 R
A. versicolor (Vuill.) Tiraboshi	4 L	-	-
Chaetomium globosum Kunze	-	10 H	2 R
Chrysosporium	11 H	20 H	13 H
C. indicum (Randhawa & Sandhu) Garg	1 R	17 H	13 H
C. keratinophilum (Frey) Carmichael	3 L	-	-
C. pannorum (Link) Hughes	2 R	3 L	-
C. tropicum Carmichael	5 M	3 L	4 L
Cunninghamella	-	2 R	4 L
C. echinulata Thaxter	-	1 R	4 L
C. elegans Lender	-	1 R	-
Fusarium	2 R	-	4 L
F. dimerum Penz.	-	-	1 R
F. oxysporum Sheldon	2 R	-	-
F. solani (Mart.) Sacc.	-	-	3 L
Geotrichum candidum Kink.	1 R	-	1 R
Gliocladium roseum Bainier	-	-	3 L
Mucor	2 R	3 L	3 L
M. circinelloides Van Tieghem	2 R	-	2 R
M. hiemalis Wehmer	-	-	1 R
M. racemosus Fresenius	-	3 L	-
Paecilomyces	2 R	1 R	-
P. inflatus (Burnside) Carmichael	2 R	-	-
Paecilomyces sp.	-	1 R	-
Penicillium	5 M	9 M	7 M
P. aurantiogriseum Diercky	-	5 M	-
P. chrysogenum Thom	5 M	2 R	-
P. citrinum Thom	-	3 L	1 R
P. funiculosum Thom	-	-	4 L
P. jensenii Zaleski	-	1 R	-
P. purpurogenum Stoll	-	-	2 R
Rhizopus stolonifer (Ehrenb.) Lind.	-	-	4 L
Scopulariopsis	12 H	4 L	10 H
S. brevicaulis (Sacc.) Bainier	3 L	4 L	10 H
S. brumptii Salvanet-Duval	6 M	-	-
S. candida (Gueguem) Vuillemin	1 R	-	-
S. koningii (Oud.) Vuillemin	10 H	-	-
Syncephalastrum racemosum (Cohn) Schroeter	-	2 R	3 L
Trichophyton mentagrophytes (Robin) Blanchard	-	-	2 R
Trichothecium roseum (Pers.) Link	-	1 R	-
Tritirachium aryzae Van Beyma	-	-	1 R
Sterile mycelia (white & dark colour)	2 R	1 R	1 R

Trichophyton mentagrophytes which appeared in rare incidence (10 % of broiler feather samples) in this work was previously reported to be common on the hair of some mammals in West Bank of Jordan (Ali-Shtayeh *et al.*, 1988 a, b).

The remaining genera and species listed in Table 1, were less frequently isolated from one type or more of the keratinaceous materials.

b) Thermophilic and thermotolerant fungi

Nine species belonging to 8 genera were recovered from cow hairs (5 genera and 5 species), layer strains (7 genera and 7 species) and broiler feathers (8 genera and 8 species) using yeast - starch agar at 45 °C as shown in Table 2.

Table 2 - Numbers of cases of isolation of thermophilic and thermotolerant fungi recovered from the flooring materials and keratinaceous substrates of cow and chickens on yeast starch agar at 45°C.

Genera and Species	Flooring materials (24 samples)			Keratinaceous substrates (20 samples)		
	Cow manure	Layer strains litter	Broiler litter	Cow hair	Leather strains feather	Broiler feather
Aspergillus	23	24	24	20	17	16
A. flavus Link	16	12	14	-	-	-
A. fumigatus Fresenius	20	21	23	20	17	16
A. niger Van Tieghem	15	14	16	-	-	-
A. sydowii (Bain. & Sart.) Thom & Church	-	-	1	-	-	-
A. terreus Thom	19	19	21	-	-	3
Emericella	18	17	21	9	4	7
E. nidulans (Eidam) Vuillemin	15	17	19	9	4	7
E. quadrilineata (Thom & Raper) Benjamin	11	12	1	-	-	-
Malbranchea sulfurea (Miehe) Siger & Carmichael	7	-	6	-	-	-
Mucor racemosus Fresenius	4	10	4	15	9	14
Paecilomyces	5	12	6	4	9	1
P. humicola Onions & Barron	1	-	-	-	-	-
P. variotii Bain	-	12	6	4	9	8
Rhizomucor pusillus (Lindt) Schipper	20	22	24	6	18	17
Rhizopus	14	15	6	-	4	12
R. rhizopooliformis (Cohn) Zopf	-	15	6	-	4	12
R. stolonifer (Ehrenb.) Lindt	14	7	-	-	-	-
Thermomyces lanuginosus Tsiklinsky	12	11	15	-	2	10

Aspergillus was the most prevalent genus being recovered from 80-100% of the keratinaceous materials. *A. fumigatus* (80-100% of the samples) and *A. terreus* (15% of broiler feather) were the two representative species of *Aspergillus*. Other thermotolerant fungi were also isolated from the three substrates and these were *Emericella nidulans, Mucor racemosus* and *Paecilomyces variotii.*

Truly thermophilic fungi such as *Malbranchea sulfurea, Rhizomucor pusillus, Rhizopus rhizopodiformis* and *Thermomyces lanuginosus* were commonly isolated from the keratinaceous materials. Most of these species were also found to contaminate human and buffalo hairs incubated at 45°C (Moharram *et al.*, 1989).

Table 3 - Moisture content (MC), total soluble salts (TSS), pH values, total counts (TC) of mesophilic fungi and number of fungal species (NS) estimated in the monthly samples of flooring materials under cows and chickens during the period from January to December 1988.

	Cow manure					Layer strain litter					Broiler litter				
Months	MC	TSS	PH	ATC	NS	MC	TSS	PH	ATC	NS	MC	TSS	PH	ATC	NS
January	11.5	0.12	9.2	73.0	18	18.5	0.17	7.1	183.3	21	4.5	0.17	7.4	91.0	28
February	10.5	0.32	9.1	87.7	19	23.0	0.17	7.5	144.0	23	8.0	0.29	7.9	126.3	30
March	26.6	0.32	9.2	37.0	7	13.5	0.17	7.5	97.7	7	3.5	0.17	7.5	139.0	17
April	20.0	0.20	9.0	65.5	10	20.0	0.07	7.5	118.8	9	7.0	0.17	7.8	95.0	14
May	25.0	0.40	9.1	41.8	9	23.0	0.09	7.5	166.0	21	7.5	0.27	6.6	142.5	24
June	13.5	0.28	9.0	52.8	14	20.0	0.17	7.0	33.5	10	8.0	0.29	6.8	120.7	11
July	15.5	0.20	8.4	16.5	7	22.0	0.13	7.9	18.3	11	9.0	0.33	7.2	85.7	11
August	22.0	0.12	8.1	52.2	7	18.0	0.17	7.6	44.7	19	10.5	0.27	7.1	57.7	11
September	23.0	0.32	8.7	85.7	9	15.0	0.30	7.7	63.5	15	7.0	0.17	6.6	133.3	12
October	18.0	0.36	8.4	27.3	9	17.0	0.23	7.5	40.7	13	5.0	0.17	7.0	27.3	[illegible]
November	15.0	0.20	8.6	43.2	14	25.0	0.07	8.0	68.1	18	8.0	0.27	8.3	85.8	16
December	23.0	0.28	8.7	58.2	13	21.5	0.27	8.0	106.2	19	11.0	0.07	8.5	113.7	27

II - Monthly fluctuations of fungi in cow manure and chicken litter

a) Physicochemical characteristics of the flooring materials (Table 3)

The moisture content was relatively high in cow manure and layer strains litter ranging from 10.5-26.6% and 13.5-25% respectively. Broiler litter contained lower quantities of moisture ranging from 3.5-11%. The total soluble salts was generally low in the different flooring materials varying from 0.07-0.4%. The pH values were always in the alkaline side in case of cow manure (8.1-9.2) and around neutrality or alkalinity in chicken litter (6.6-8.5). No marked correlation between the changes in the physicochemical characteristics of the flooring material and the monthly fungal counts or the number of species of either mesophilic or thermophilic fungi.

b) Mesophilic fungi

With reference to the data in table 4 it could be observed that fifty three species and 2 species varieties appertaining to 20 genera were collected during the period from January to December 1988 from cow manure (11 genera, 27 species and 1 variety), layer strains (15 genera, 36 species and 2 varieties) and broiler litter (15 genera, 35 species and 2 varieties). The monthly total counts of fungi (Fig. 1) showed generally irregular fluctuations varying from 16.5-87.7, 18.3-183.3 and 27.3-142.5 colonies/mg dry sample and the highest counts were estimated during February, January and May in cow manure, layer strains and broiler litter respectively. The most common genera on manure and litter were *Aspergillus, Emericella, Eurotium, Fusarium, Mucor, Penicillium, Rhizopus* and *Scopulariopsis*. The monthly counts of these genera did not show any regular fluctuations. Working with broiler litter Lovett *et al.* (1971) found that *Penicillium* and *Scopulariopsis* were common while *Fusarium, Aspergillus* and *Mucor* were less frequent. Most of the above genera were previously recovered with variable densities from faecal samples of cattle and poultry from some Egyptian Governorates (Lotfi *et al.*, 1986; Sobih *et al.*, 1986; El-Badry & Sokkar, 1988). From the above genera, the most frequent species were *Aspergillus flavus, A. flavus* var. *columnaris, A. fumigatus, A. niger, A. sydowii, A. terreus, A. versicolor, Emericella nidulans, Eurotium amstelodami, E. chevalieri, Mucor plumbeus, M. racemosus, Penicillium aurantiogriseum, P. oxalicum, Rhizopus stolonifer* and *Scopulariopsis brevicaulis*. The monthly variation in the counts of these species were generally of irregular pattern and were almost similar to their respective genera. In addition to the above species other fungal species were found to be more frequent on one or two types of the flooring materials and these were *Botryotrichum piluliferum, B. atrogriseum, Cladosporium cladosporioides, C. herbarum, Mucor circinelloides, Penicillium funiculosum, P. duclauxi, P. variabile, P. janczweskii, Scopulariopsis koningi, S. candida, Aspergillus ochraceus, A. tamarii, Phoma glomerata, Fusarium moniliforme, F. solani* and *Paecilomyces variotii* (Table 4). Most of the above species were frequently encountered from the faecal material or droppings of cattle and poultry in samples collected from Assiut, Sohag and Qena Governorates, Upper Egypt (Lotfi *et al.*, 1986; Sobih *et al.*, 1986; Moharram *et al.*, 1987 and El-Badry and Sokkar, 1988). In U.K., Dennis and Gee (1973) found that the most common fungi of broiler house litter were *Aspergillus sydowii, A. versicolor, A. repens, A. amstelodami, A. ruber, A. chevalieri, A. flavus, A.*

	Cow manure	Layer strains litter	Broiler litter
Genera and species	NCI & OR	NCI & OR	NCI& OR
Absidia corymbifera (Cohn) Sacc.	-	4 L	-
Acremonium strictum W. Gams	-	-	4 L
Alternaria alternata (Fries) Keissler	1 R	4 L	7 M
Aspergillus	24 H	24 H	24 H
A. candidus Link	2 R	-	-
A. carneus (V. Tiegh.) Blochwitz	-	-	-
A. flavus Link	20 H	22 H	23 H
A. flavus var. *columnaris* Raper & Fennell	8 M	8 M	7 M
A. fumigatus Fresenius	12 H	17 H	20 H
A. niger Van Tieghem	23 H	23 H	22 H
A. ochraceus Wilhelm	3 L	-	6 M
A. parasiticus Speare	5 L	5 L	10 M
A. sydowii (Bain. & Sart.) Thom & Church	5 L	10 M	10 M
A. tamarii Kita	-	-	8 M
A. terreus Thom	12 H	4 L	15 H
A. terreus var. *africanus* Fennell & Raper	-	3 L	-
A. versicolor (Vuill.) Tiraboschi	5 L	7 M	11 M
A. wentii Wehmer	3 L	-	-
Botryotrichum	-	10 M	6 M
B. atrogriseum Van Beyma	-	-	6 M
B. piluliferum Sacc. & March.	-	10 M	-
Chaetomium globosum Kunze	-	1	-
Circinella muscae (Sorok) Berl & Detoni	5 L	-	-
Cladosporium	-	7 M	-
C. cladosporioides (Fres) De Vries	-	7 M	-
C. herbarum (Pers) Link	-	7 M	-
Emericella	4 L	10 M	7M
E. nidulans (Eidam) Vuillemin	4 L	10 M	6 M
E. nidulans var. *lata* (Thom & Raper) Subram.	-	-	8 L
Eurotium	6M	4 L	9 M
E. amstelodami Mangin	5 L	4 L	8 M
E. chevalieri Mangin	2R	3 L	4 L
Fusarium	3 L	16 H	18 H
F. equiseti (Corda) Sacc.	-	4 L	-
F. moniliforme Shelon	2 R	9 M	7 M
F. solani (Mart.) Sacc.	1 R	8 M	11 M
F. tabacinum (Beyma) W. Gams	-	4 L	-
Mucor	15 H	15 H	18 H
M. circinelloides Van Tiegh.	-	8 M	3 L
M. plumbeus Bonord	6 M	7 M	7 M
M. racemosus	11 M	7 M	17 H
Paecilomyces variotii Bain.	1 R	7 M	9 M
Penicillium	19 H	21 H	18 H
P. aurantiogriseum Dierckx	3 L	7 M	12 H
P. brevicompactum Dierckx	-	-	5 L
P. chrysogenum Thom	19 H	16 H	17 H
P. duclauxii Delacroix	-	-	7 M
P. funiculosum Thom	-	7 M	-
P. janczewskii Zaleski	-	8 M	7 M
P. oxalicum Currie & Thom	13 H	7 M	9 M
P. rugulosum Thom	5 L	-	4 L
P. sublateritium Biourge	-	2 R	-
P. variabile Sopp	-	-	7 M
Phoma glomerata (Corda) Wollen. & Hochap.	-	-	6 M
Rhizopus	17 H	17 H	15 H
R. rhizopodiformis (Cohn) Zopf	-	-	3 L
R. stolonifer (Ehrenb.) Lind	17 H	17H	15 H
Scopulariopsis	6 M	19 H	19 H
S. brevicaulis (Sacc.) Bainier	6 M	18 H	16 H
S. brumptii Salvanet Duval	1 R	-	-
S. candida (Gueguem) Vuillemin	-	6 M	8 M
S. koningii (Oud.) Vuillemin	-	8 M	-
Syncephalastrum racemosus (Cohn) Schroeter	-	4 L	-
Thamnostylum sp.	-	-	5L
Trichoderma harzianum Rifai	-	-	3 L

Table 4 - Average total counts (ATC, colonies/mg dry manure or litter in all samples), number of cases of isolation (NCI, out of 24 samples) and occurrence remarks (OR) of fungal genera and species recovered from cow manure, layer strains and broiler litters on glucose-Czapek's agar at 28°C.
Occurrence remarks: H= high occurrence, isolated from 12-14 cases (out of 24); M = moderate occurrence, from 6-11 cases; L = low occurrence, from 3-5 cases; R = rare occurrence, 1 or 2 cases.

candidus, Scopulariopsis brevicaulis, Paecilomyces variotii, Penicillium crustosum and *Absidia cylindrospora.*

c) Keratinophilic fungi

Twenty species and 1 variety representing 9 genera were collected from the monthly samples of cow manure and chicken litter (Table 5). *Chrysosporium* was the most common genus occurring in 10-12 months. Of the 6 *Chrysosporium* species *C. indicum* and *C. tropicum* were the most prevalent which occurred in 12.5-50 % of the

Table 5 - Number of cases of isolation (NCI, out of 12 samples), and occurrence remarks (OR) or keratinophilic fungi recovered from each of cow manure, layer strains and broiler litters baited with cow hair fragments ■ 25°C.

Genera and species	Chicken litters		
	Cow manure	Layer strains	Broiler
	NCI & OR	NCI & OR	NCI & OR
Acremonium	3M	-	1 R
A. strictum W. Gams	3 M	-	-
Acremonium sp.	-	-	1 R
Aspergillus	3 M	-	10 H
A. flavus Link	2 L	-	6 H
A. flavus var. *columnaris* Raper & Fennell	1 R	-	-
A. fumigatus Fresenius	-	-	6 H
A. terreus Thom	-	-	8 H
Chrysosporium	12 H	12 H	10 H
C. carmichaelii Van Oorschot	-	-	6 H
C. indicum (Randhawa & Sandhu) Garg	8 H	4 M	3 M
C. keratinophilum (Frey) Carmichael	1 R	-	3 M
C. pannorum (Link) Hughes	2 L	-	-
C. queenslandicum Apinis & Rees	4 M	-	-
C. tropicum Carmichael	10 H	12 H	6 H
Emericella nidulans (Eidams) Vuill.	-	-	2 L
Gymnoascus reticulatus Zukal	-	-	1 R
Microascus trigonosporus Emmons et Dod.	1 R	-	-
Penicillium	2 L	3 M	1R
P. aurantiogriseum Dierckx	2 L	-	-
P. funiculosum Thom	-	3 M	1 R
Thermoascus aurantiacus Miehe	1 R	-	-
Scopulariopsis	2 L	6 H	2 L
S. brevicaulis (Sacc.) Bainier	-	-	2 L
S. brumptii Salvanet-Duval	-	6 H	-
S. koningii (Oud.) Vuil.	2 L	-	-
Sterile mycelia (dark colour)	-	-	1R

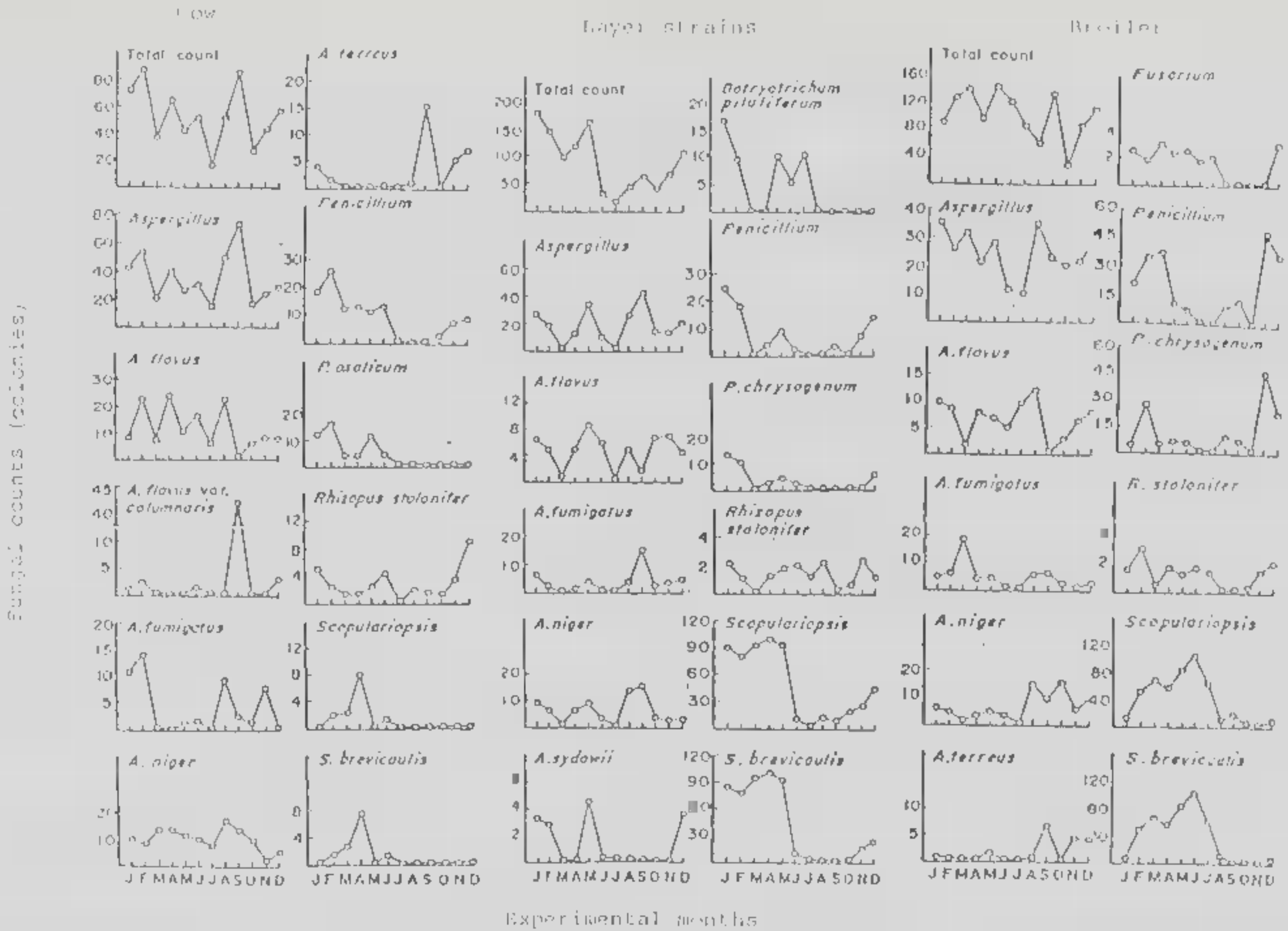

Fig. 1 - Monthly counts (colonies/mg dry sample) of mesophilic fungi recovered from the flooring materials under cows and chickens during the period from January to December 1988.

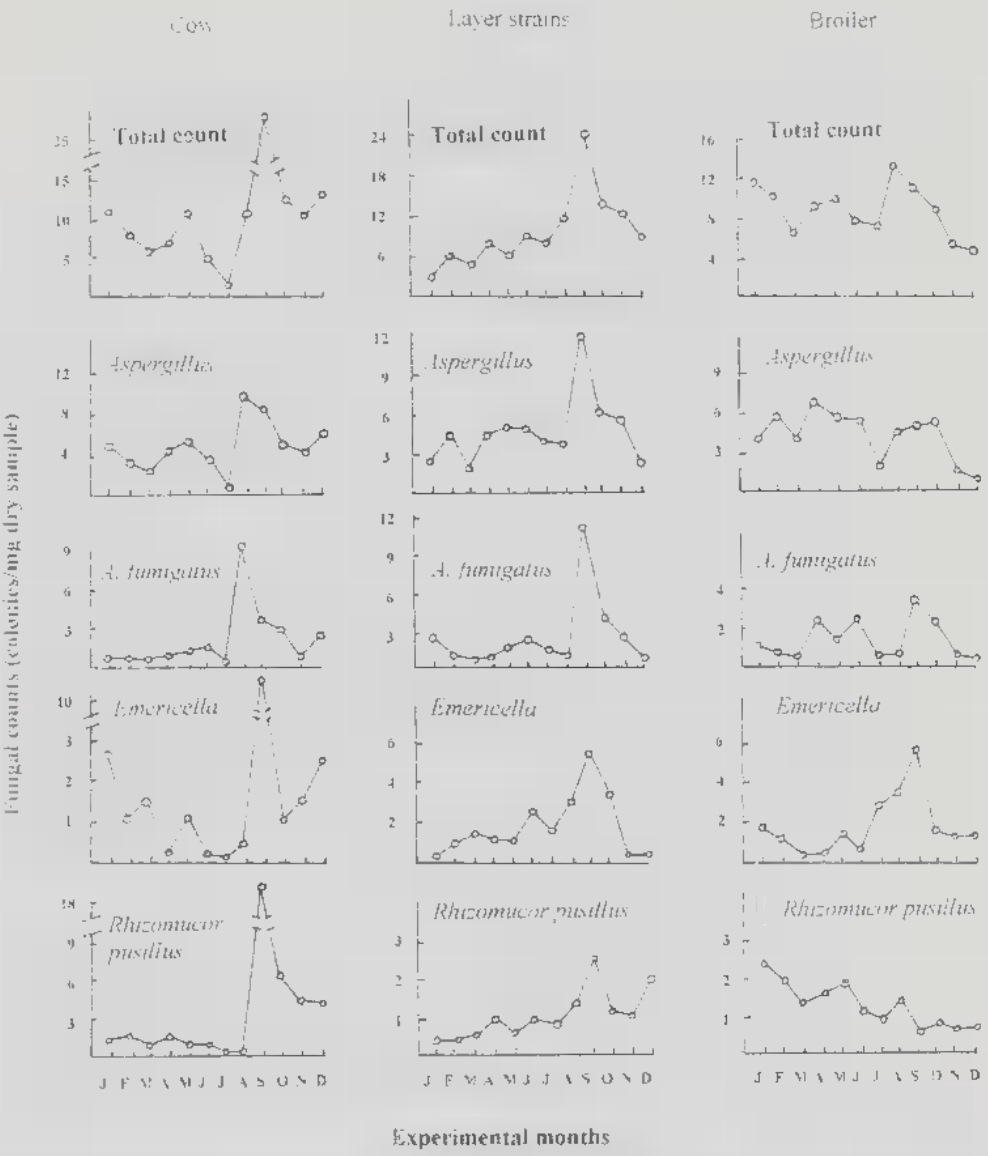

Fig. 2 - Monthly counts (colonies/mg dry sample) of common thermophilic and thermotolerant fungi recovered from the flooring materials under cows and chickens during the period from January to December 1988.

samples. The remaining *Chrysosporium* species appeared in one or two types of the flooring materials such as *C. carmichaelii* from broiler litter, *C. queenslandicum* from cow manure, *C. keratinophilum* from cow manure and broiler litter. Some of these

species were previously encountered from animal and bird pens in Egypt (Bagy *et al.*, 1989).

Numerous cycloheximide resistant fungal species appeared also in the isolation plates as those belonging to *Acremonium, Aspergillus, Emericella, Gymnoascus, Microascus, Penicillium, Thermoascus, Scopulariopsis* and sterile mycelia.

d) Thermophilic and thermotolerant fungi

Sixteen species belonging to 9 genera were identified during the experimental period which extended from January to December 1988 (Table 6). The monthly counts of total fungi (Fig. 2) were irregularly fluctuating between 1.4-38.8, 3.4-25.2 and 4.5-13.1 colonies/mg dry sample with the highest counts being recorded during August and September 1988.

Aspergillus, Mucor, Paecilomyces and *Rhizopus* were frequently encountered from the three substrates. Of these genera, the common species were *A. flavus, A. fumigatus, A. niger, A. terreus, Emericella nidulans, E. quadrilineata, Mucor racemosus, Paecilomyces humicola, P. variotii* and *Rhizopus stolonifer*. The monthly counts of each of these species did not show any regular fluctuations and some of them appeared intermittently during the experimental period. *Malbranchea sulfurea, Rhizomucon pusillus, Rhizopus rhizopodiformis* and *Thermomyces lanuginosus* appeared also intermittantly in the monthly samples of cow manure, layer strains and broiler litter. Most of these thermotolerant and thermophilic fungi were reported to be recovered from dung and manure (Cooney & Emerson, 1964; Seal & Eggins, 1972; Minoura *et al.*, 1973) and from poultry droppings (Ogundero, 1979).

From the previous results and discussion it could be concluded that the cows hair, the chickens feather and the flooring materials inside houses of these animals or birds are heavily contaminated with propagules of several saprophytic and pathogenic moulds. The pathogenicity of several fungal species such as *Trichophyton mentagrophytes, A. fumigatus, A. flavus, E. nidulans, Scopulariopsis brecaulis* to animals, birds and even to man has been reported by several authors (Onsberg, 1980; Velez and Diaz, 1985) and others.

It is therefore advisable to reduce these pathogenic moulds inside cattle and chicken houses either by continuous cleaning and good aeration or by using suitable disinfectants and antifungal agents. Also, all workmen in the cattle or poultry houses should be advised to follow the hygienic precautions to avoid infection by the harmful fungi.

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